Art. XIV.—*On the Occurrence of the Genus Linthia in Victoria, with description of a new species.*

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(With Plates XXII., XXIII.).

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For several years the occurrence of a gigantic species of echinoderm in the Batesford Limestone, Geelong, has been known to me by abundant fragments and imperfect portions of a very large test. In 1890 I obtained an entire but very badly crushed example, which, together with the previously obtained fragments, was then regarded as *Pericosmus gigas*, McCoy, and was recorded as such from the above locality, in a paper on the Geology of the Southern Portion of the Moorabool Valley.[1]

This record should now be expunged, for more recently I obtained the largest and most perfect example I have yet seen, and careful examination of this shows it to belong undoubtedly to the genus *Linthia*, and not to *Pericosmus*. The late Sir F. McCoy records[2] *Pericosmus gigas* from Corio Bay, Geelong, but the specimen as preserved in the National Museum, Melbourne, being very imperfect and badly broken, shows a good deal of the matrix, and unfortunately no such matrix is known to occur at Corio Bay.

It is possible that this specimen may have come from the Batesford Quarries, and if such should have been the case, it is likely that *Pericosmus gigas*, as well as the large new species of *Linthia* herein described, may have existed in the same locality.

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1 Proc. Roy. Soc. Vic., vol. iv., n.s., pt. i., p. 18.

2 Prod. Pal. Vic., dec. vii., p. 15, pls. 64, 65.

Until recently the only Australian Older Tertiary record of *Linthia* was that of Professor R. Tate, in 1885,[1] when he attached the name of *Linthia antiaustralis* to an echinoid from the River Murray Cliffs, near Morgan.

In his revision of our echinoids in 1891[2] this was still the only species known. *Linthia* has recently been recorded[3] from Victoria, when the above Murray Cliffs fossil, *L. antiaustralis*, Tate, has been referred to as occurring at Curlewis, near Geelong.

In order to make the present description as complete as possible, I have thought it as well to include a full description of the generic characters as given by Professor Martin Duncan in his Revision of the Echinoidea.[4]

Genus Linthia, Merian, 1853.

Test variable, small to large, oval or cordiform, grooved anteriorly, subacuminate or truncated posteriorly, tumid and gibbose dorsally, almost flat actinally. Apical system small, excentric in front; four perforated basal plates; the madreporite separating the posterior basal plates and also the posterior radial plates.

Ambulacra diverse; the anterior in the broad groove, the pores round and small, the antero-lateral long, with the petaloid parts in grooves., moderately long, divergent, pairs of pores, equal or subequal, nearly closing distally; postero-lateral ambulacral petals also in sunken grooves, less divergent and shorter than the others. Ambulacra forming the greater part of the peristomial margins, and moderately broad on either side of the sternum. Peristome excentric in front, semilunar, with well-developed posterior labrum. An amphisternum; the second plates of both of the zones of the right posterior ambulacrum united, so as to produce ancient heteronomy. Periproct at the upper part of the posterior truncation.

1 Southern Science Record, vol. i., n.s., No. 1, Jan., 1885.

2 Trans. Roy. Soc. S.A., vol. xiv., pt. ii., p. 277.

3 F. Chapman, Victorian Fossils, pt. ix., 1908; Proc. Roy. Soc. Vic., vol. xx., n.s., pt. ii., p. 215, pl. xix., f. 1, 2, 3.

4 Jour. Lin. Soc. Lond., Zool., vol. xxiii., 1891, p. 233.

A peripetalous fasciole entering the interradia, a lateral fasciole starting from the peripetalous close to the antero-lateral ambulacra and passing beneath the periproct.

Tubercles crowded, largest actinally, usually crenulate and perforate, and either on flat or in sunken scrobicules.

I.—Linthia mooraboolensis, sp. nov.

(Pl. XXII., Figs. 1, 2; Pl. XXIII., Figs. 3, 4).

Description.—The test is very much depressed, and quite as tumid post-medially on the base or actinal surface, as behind the apex on the abactinal surface, becoming relatively much more flattened towards the anterior margin. The marginal contour is circular to very slightly elliptical, there usually being a little greater length in the antero-posterior diameter; deeply but narrowly grooved in front, where the odd anterior ambulacrum runs, and the groove is not of uniform width, having its maximum width about midway between the apical system and the anterior margin, and its minimum width, which is about one-third of the maximum, at one-fourth of this distance from the anterior. The anterior groove indents the margin to the extent of one-tenth of the antero-posterior diameter.

Upper surface very slightly convex, greatest convexity in the posterior interambulacrum, but not strikingly keeled.

Seen in lateral profile the maximum height of the test is situated at one-third the diameter from the posterior margin, abactinally gradually sloping to the anterior and posterior, actinally almost flat to the peristome, but running up at very low angle to the periproct.

The transverse profile is biconvex, more regular dorsally, but ventrally flattening towards the ambitus, which in consequence is not very tumid, but rather suddenly rounded.

Sternum convex, broadly lanceolate, well defined laterally by the posterior ambulacra, with two strong posterior tumidities, between which a shallow groove runs up to the elliptical periproct, the latter being obliquely set immediately below the margin. Peristome large, semilunate, eccentric to the front, and very close to the anterior notch, with a strongly swollen

posterior labrum. Ambulacra petaloid, unequal, narrow, but deeply sunken, anterior pair (70 mm. in the type) longer than the posterior pair (55 mm.), the anterior pair showing an angle of divergence of 125 degrees, whilst the posterior pair diverge at an angle of 50 degrees, all showing a slight forward curvature at their extremities. The odd anterior ambulacrum shallow at first, then broadening and deepening, then further deepening and narrowing owing to the overhanging and closely approaching margins.

Pores conjugate, upper series usually ovate, whilst the lower series are sometimes more nearly circular or only slightly elliptical, each ambulacral plate being perforated very near its lower suture; between thirty and forty pairs of pores exist in each poriferous zone, the smaller number being in the posterior petals.

The tubercles are remarkable in this species for their extreme fineness, very minute mammillation, and uniformity on the greater part of the abactinal surface, becoming a little coarser towards the anterior notch. The sternum is medially finely tuberculate, but becomes much more coarsely sculptured towards the posterior ambulacral plates, between the latter and the ambitus the coarsest tubercles occur, and these also show a marked increase in size towards the front margin.

Tubercles perforate, scrobiculate, and the coarser on the base faintly crenulate, abactinal tubercles a little obliquely and backwardly directed, the boss usually being eccentric on the scrobicule, which has the appearance of a flat surface, and very minute granules or miliaries surround the outside of the scrobicule.

Finest scrobicules run three in 2 millimetres, while the coarsest are of about 1 millimetre in diameter, and the coarsest tubercle is not more than half a millimetre in diameter.

There is a well developd but narrow (width, 1 mm.), and very sinuous peripetalous fasciole, which margins very close up to the petals; a still narrower (about .5 mm.) lateral fasciole starts from the peripetalous fasciole just a little behind and above the end of the antero-lateral petal, runs gradually towards the margin, then parallel with it for a distance before dropping below the margin, and apparently dips under the anus, but the

latter portion of its course is not absolutely distinct in the specimens before me.

Dimensions.—Longitudinal diameter, 195 millimetres; transverse diameter, 185 mm.; height, 55 mm.; Periproct, 20 mm. by 15 mm.; Peristome, 23 mm. by 4 mm.; thickness of test, 2 mm.

Locality.—Polyzoal Limestones of the Filter Quarries, Batesford, Moorabool Valley.—Balcombian—Eocene.

Observations.—In this species one is struck by the very large size associated with a comparatively thin and weak test, and this no doubt accounts for the large number of fragments or crushed specimens obtainable as against perfect examples, which have hitherto been very rare. This form appears to be one of the largest, if not the largest, species of the genus; but I am not in a position to assert positively on this point, as I have not yet had access to all the described species.

From *Pericosmus gigas*, McCoy, which, by the way, is also referable to the genus *Linthia*, the present species differs in its much more depressed form, its profile views being very distinctive, the anterior notch shows many divergent features, the ornamentation is of a much finer character, the tubercles are not so ornate, the fascioles are narrower and follow a rather different course, and the anterior petals diverge at a much smaller angle, and the poriferous plates are more crowded. The proportion of height to length in *P. gigas* is given as 45 : 100, whilst in the present species it is only 28.2 : 100.

II.—Linthia gigas, McCoy, sp.

1882. Pericosmus gigas, McCoy. Prod. Pal. Vic., Dec. vii., pp. 15, 16, plates 64, 65.

1892. Pericosmus gigas, Hall and Pritchard. Proc. Roy. Soc. Vic., vol. iv., n.s., pt. 1, p. 18.

1892. Pericosmus gigas, Pritchard. Ann. Report South Aust. School of Mines and Industries, p. 185.

Observations.—The original records of the occurrence of this species have unfortunately been of a somewhat ambiguous nature. The type was indicated by McCoy as from the banks

of the Murray, near its junction with the Darling, but those who know this locality have very grave doubts about its correctness. Then, again, Corio Bay is given as a locality, but the specimen preserved in the National Museum is certainly not in Corio Bay matrix, and it seems probable that the locality should have been Batesford.

Professor Tate[1] in his treatment of our echinoids only repeats McCoy's original localities, and nothing is added to our knowledge by Dennant and Kitson's Catalogue,[2] while the latest is a very doubtful record on fragmentary remains of a very large echinoid from near the junction of the Grange Burn and Muddy Creek, Western Victoria, by Mr. F. Chapman.[3]

Having regard to the characters of this echinoid, there seems very little doubt but that McCoy's species is better placed in the genus *Linthia*, and McCoy himself was not absolute in placing it as a *Pericosmus*, for he states: "I refer the fossil provisionally to *Pericosmus* as an aberrant species." The imperfect remains recorded by Mr. Chapman from our Western District are referred to as probably *Linthia gigas*.

In transferring this large species of echinoid to the genus *Linthia*, the possibility of the foregoing new species herein described, being only a form of *L. gigas*, has not been lost sight of, especially when one finds such enormous variability in all our echinoid species, which can be collected in large numbers. Still the characters in the specimens hitherto obtained of the new species appear to run along sufficiently divergent lines to warrant a distinctive name.

Linthia gigas may be characterised by being a very large convexly rounded species with strongly swollen ambitus, very widely divergent anterior-lateral petals, which are distinctly sigmoidal, in general shape somewhat ovate, and nearly half as high as long.

III.—Linthia antiaustralis, Tate.

1885. Linthia antiaustralis, Tate. Southern Science Record, vol. i., n.s., No. 1, January, pp. 4, 5.

1 Trans. Roy. Soc. S.A., 1891, vol. xiv., pt. ii., p. 277.
2 Rec. Geo. Surv. Vic., vol. i., pt. ii., p. 131.
3 Proc. Roy. Soc. Vic., 1908, vol. xx., n.s., pt. ii., p. 217.

1908. Linthia antiaustralis, Chapman. Proc. Roy. Soc. Vic., vol. xxii., n.s., pt. 2, pp. 215, 216, plate xix., f. 1, 2, 3.

Observations.—This species had not been recognised as occurring in Victoria until a recent publication by Mr. Chapman, when Curlewis, near Geelong, is given as its locality, though the specimen was apparently collected by Mr. Daintree as early as 1861. Professor Tate's original particulars concerning this species are of the most meagre description, and failing a close and critical comparison, either with the type, or with *Linthias* of similar dimensions from the type locality, it seems to me well nigh impossible to make a certain identification. Professor Tate gives no figure of this species, but gives the dimensions as: Diameters of the base 60 mm. and 50 mm., and height 40 mm. Mr. Chapman figures the Curlewis specimen without any further descriptive particulars or dimensions, but notes in his explanation of the plate that the figures are natural size.

Figure 1 measures in length, 44 mm.; height, 27 mm. Figure 2, length, 42 mm.; width, 37 mm. Figure 3, length, 45.5 mm.; width, 39 mm.

These figures represent the profile, the dorsal view, and the ventral view respectively, but do not appear to show a very accurate agreement, and hardly seem close enough to Tate's particulars to admit of absolute certainty in the matter of this identification. With discrepancies of this kind and poor reproduction, it is little wonder that photographic reproduction of echinoids is strongly objected to in certain quarters.

I am quite aware that it is no easy matter to get good accurate photographs, and then again to follow that up by equally good reproduction; but at any rate every precaution should be taken to start well. For the sake of argument, suppose that this Curlewis echinoid does not prove to be Tate's Murray Cliffs species, then, what have we got? First a very poor original description, then figures which do not represent it, and of course many workers would be likely to look at the figures first, and we have a highly interesting position for a young student.

Such difficulties do present themselves occasionally, but surely it should be our very best endeavour to avoid the possibility of such confusion for the sake of subsequent investigators.

IV.—Linthia nelsoni, McCoy, sp.

1882. Pericosmus nelsoni, McCoy. Prod. Pal. Vic., Dec. vii., pp. 17-19, pl. 66, f. 1, 2, and pl. 67, f. 1.

1891. Pericosmus nelsoni, Tate. Trans. Roy. Soc. S.A., vol. xiv., pt. 2, p. 277.

Observations.—This species which, so far as I am aware, has only been collected from the Waurn Ponds quarries, which are situated about seven miles west of Geelong, appears on examination to require its removal from the genus *Pericosmus* to *Linthia*. All the characters of my specimens agree absolutely with those of *Linthia*, and also with McCoy's description of the above species, with the exception of the courses of the fascioles. In my examples there is a distinct and complete peripetalous fasciole, and a latero-sub-anal fasciole, which starts from the peripetalous a little above and behind the end of the anterior lateral petal. McCoy figures a basal view (plate 66, f. 2), which is very misleading in its anterior and posterior aspect. Through the courtesy of Mr. F. Chapman I have been able to examine McCoy's type and figured specimens, in addition to other examples, preserved in the National Museum, Melbourne. I was very much surprised to find McCoy's original material in such an imperfect state, and so poorly preserved, and this no doubt accounts for the discrepancies which appear to exist. On plate 66, figure 1, the posterior dorsal keel is abnormally flattened owing to crushing, whilst it is really distinctly angularly keeled in perfect specimens.

Plate 66, figure 2, shows the base of another crushed specimen, but I was unable to detect the anterior portion of the peripetalous fasciole in the position as figured; it is just discernible on the front margin, but could not be visible in the view as shown, unless the artist's licence goes so far as to permit, first, a tipping up of the posterior end to include a view of the periproct, and then a similar treatment for the front of the test, to include as much character as possible.

Figure 1, on plate 67, is wrong in its fasciole track, for while one side of this specimen is somewhat obscure, the other distinctly shows the lateral fasciole running up to and joining

the peripetalous at the rear, and a little above the end of the anterior lateral petal.

The anterior notch and the space where the odd anterior ambulacrum is lodged may be rather deeper, and the other petaloid ambulacra may be more sunken than indicated by McCoy in his description.

EXPLANATION OF PLATES.

Plate XXII.

Fig. 1.—Linthia mooraboolensis, sp. nov. Abactinal view.
,, 2.—Id. Longitudinal profile.

Plate XXIII.

Fig. 3.—Linthia mooraboolensis, sp. nov. Actinal view.
,, 4.—Id. Profile from the front.

Note.—All the figures are much reduced, the actual specimen figured being a little over 7½ inches in its greatest diameter.

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